Integrated Nutrient and Water Management for Sustainable Food Production in the Sahel

Kimaro, A. A., Akponikpè , P.B.I, Ouattara, B., Baco, M., Peak, and D, Koala, S.

"Research to feed Africa", Agricultural Research for Development Impacts – CIFSRF Africa Symposium - KARI/IDRC , 23-27 June 2014, Naivasha, Kenya

Affaires étrangères, Commerce et Développement Canada
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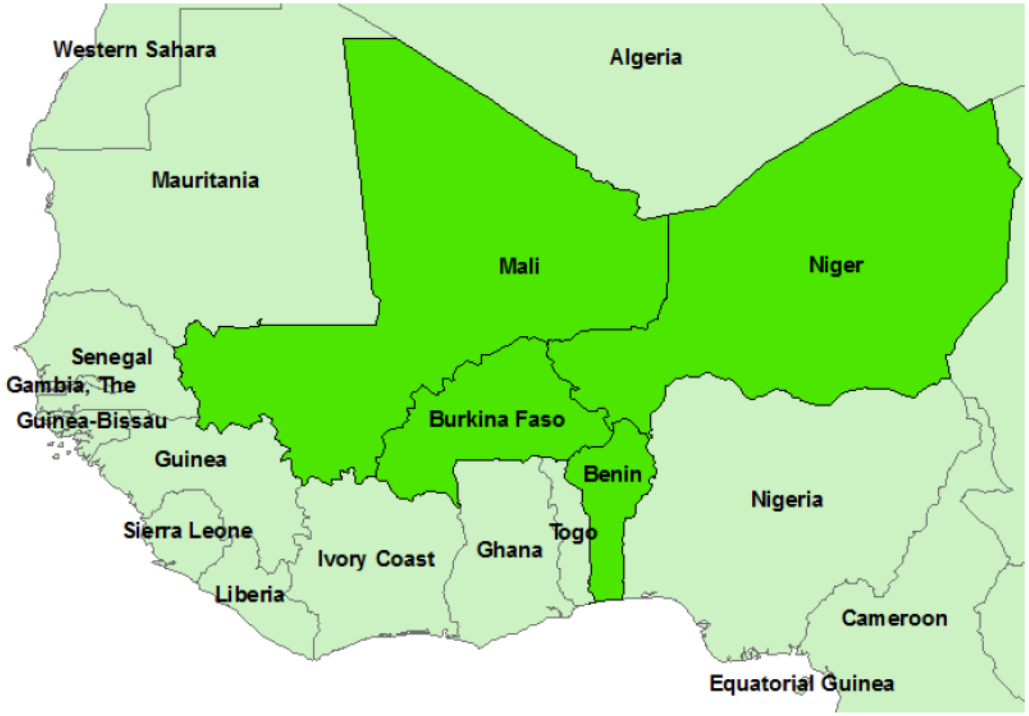
Project Rationale

- Developmental challenge
  - Low crop yield is closely linked to poverty and food insecurity
  - Agriculture contribute 30-50% GDP and employs majority
- Challenges to sustain crop production
  - Land degradation (soil fertility and OC depletions)
  - Recurrent droughts escalated by climate variability/change
- Fertilizer application improves yields but high costs of fertilizer deters farmers from using recommended rates
- Combination MD and RWH hold promise to mitigate risks (high cost & yield loses) of fertilizer use in the Sahel.
- Little information is available on the sustainability of the MD, synergies of MD & RWH, and what drives MD adoption.

Project Objectives

1. To assess the long-term effects of fertilizer microdosing
2. To promote the potential of fertilizer microdosing, RWH techniques and the warrantage system on crops production and household income.
3. To scale-out the microdosing, the RWH technologies and the warrantage system for wider adoption to increase regional food production and household income.
4. To transform lessons learnt into policy guidelines to improve agricultural productivity and ensure its sustainability

Study Site and Partners



Lead Partners

Benin

- University of Parakou

Burkina Faso

- NARS (INERA)

Mali

- NARS (IER)

Niger

- NARS (INRAN)

Canada

- U of Saskatchewan

Third party

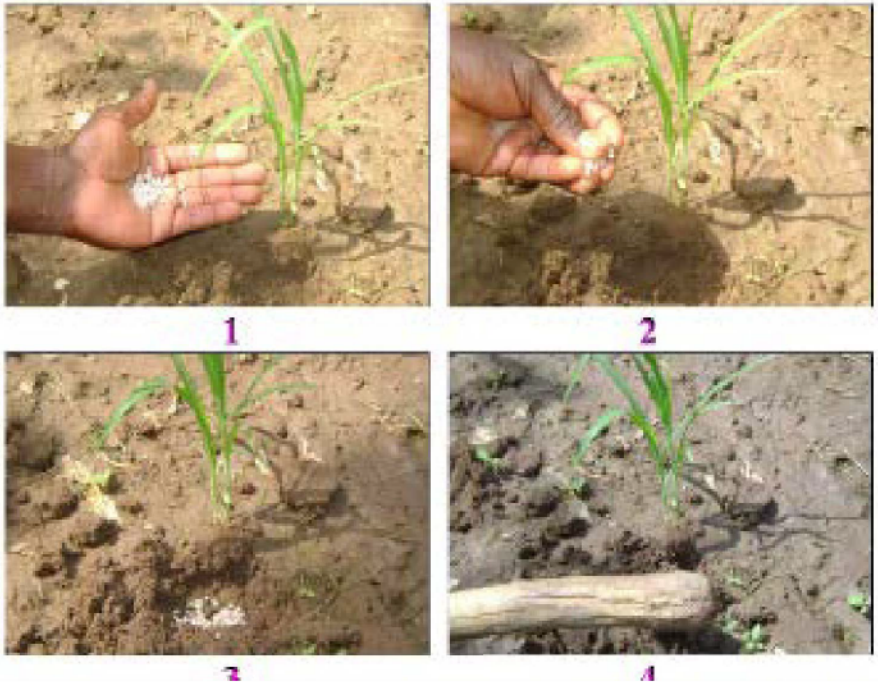
- CIAT, ICRISAT

Fertilizer Micro-dosing

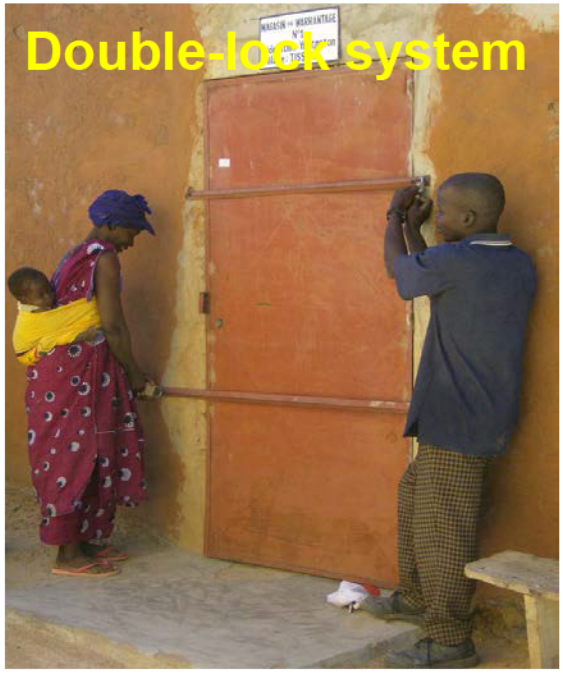
- Small doses of fertilizer (2-3g/hill as NPK; 4.4 kg P/ha) compared to recommended rates of 13 kg P/ha for millet
- Localized application at sowing or after emergence

At seed sowing

After seed germination



The Warrantage Scheme



- Crops harvest stored and used as a collateral to access credits/loan for inputs or other economic activities at home
- Link agro-dealers and farmers for timely supply of inputs
- Re-packing fertilizer into small bags enhance fertilizer access & affordability
- Regulations need to be enforced for quality control

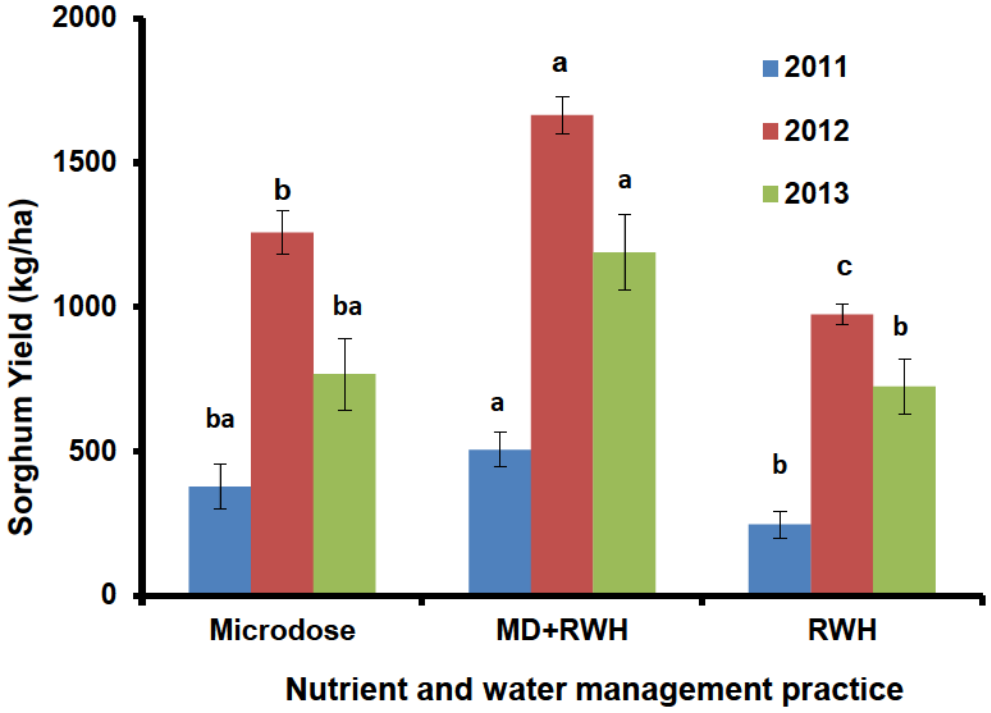
Rainwater Harvesting Techniques

Key Findings

1. Synergy between fertilizer micro-dosing and RWH
2. Sustainability of the micro-dose technology (biophysical & socio-economic aspects)
3. Determinants of micro-dose adoption
4. Gender dimensions and income-derived from micro-dose

Synergistic Effects of Micro-dose and RWH

- Micro-dose and RWH: up to 200%
- MD alone: 100% or similar to recommended rates
- RWH alone: up to 30%
- Further increase was noted with the use of improved variety

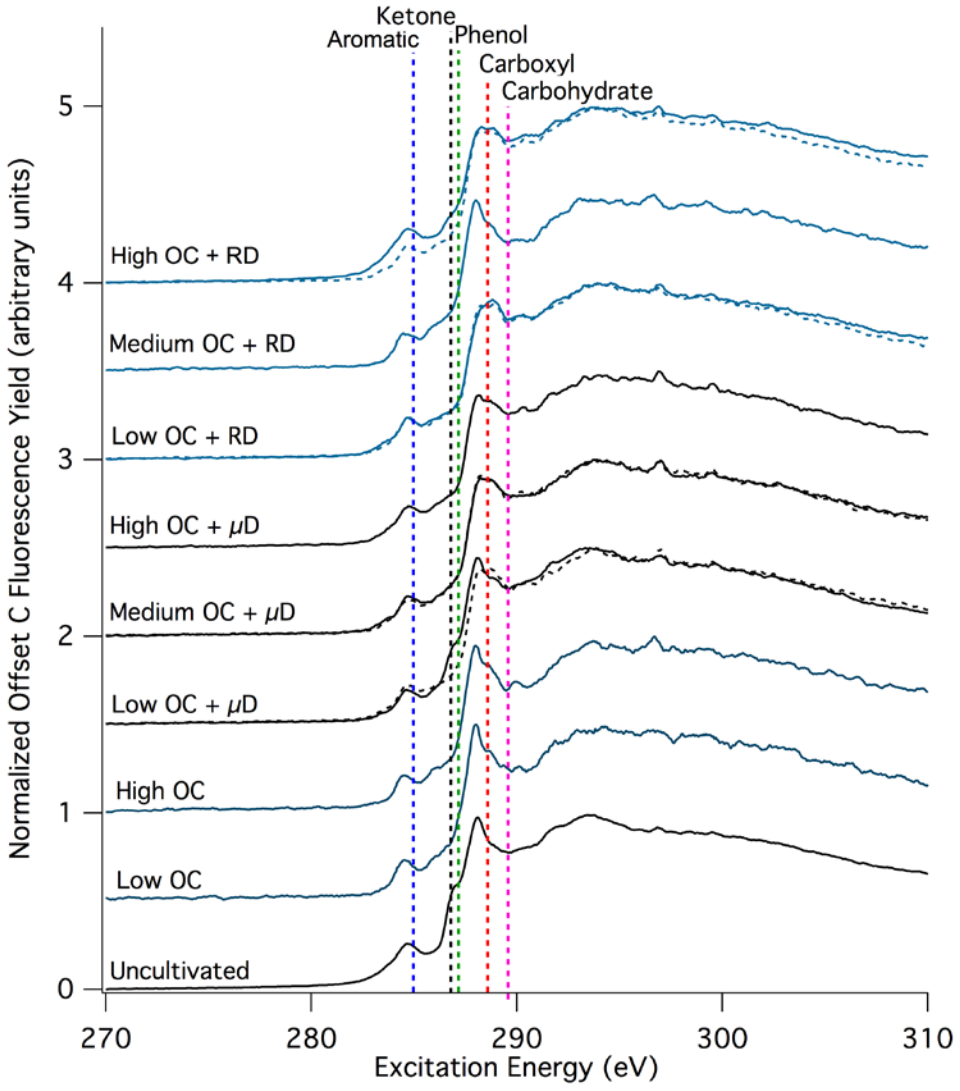


Sustainability of the Micro-dose

- Adopted long-term trials to assess trends of yields and soil quality
- Micro-dose, RWH, leaching studies to assess effects on the crops yields, uptake & soil/nutrient loss.

- Runoff from plots captured
- Lysimeter measurements

Sustainability of the Micro-dose



Long-term indicators: 1998-2013

- Similar millet yield trends in MD and recommended rate

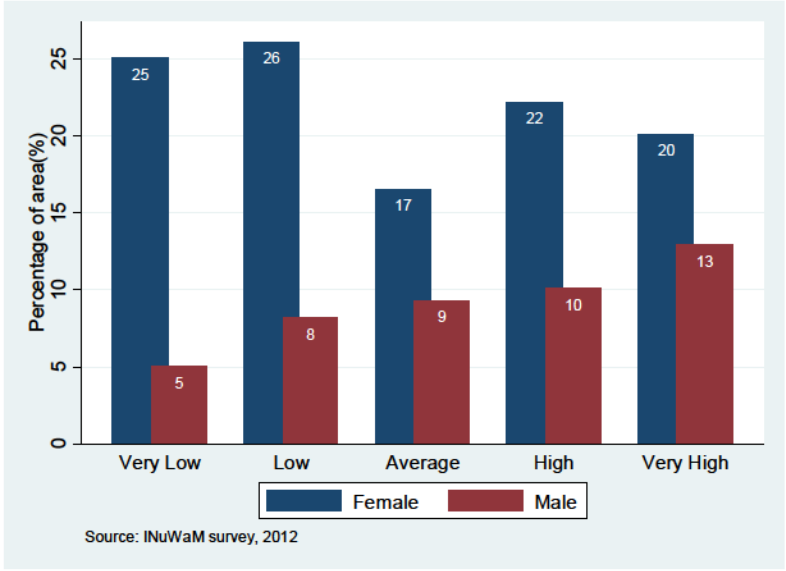
Soil quality:

- Acidification in both MD and RD treatments
- Similar carbon functional groups in MD, RD and uncultivated lands
- Inputs of OM mitigate acidification and stabilized millet yields over time

Short-term indicators: 2010-2013

- Higher NUE and WUE in MD than in RD
- CBA: higher NPV in MD than in RD

Micro-dose and Gender



- Women allocate more area to micro-dose than men
- Income of women derived from micro-dose is higher than that of men
- Higher involvement of women in micro-dose open room to extend MD application in leguminous crops such as cowpeas
- MD is a labor intensive but tools to apply micro-dose rates at sowing has been developed to relief women from additional workload

Factors Influencing Adoption of Micro-dose

		Micro-dose	
		YES	NO
Warrantage	YES	**94 %**	6%
	NO	32%	68%
Total		**40%**	**60%**

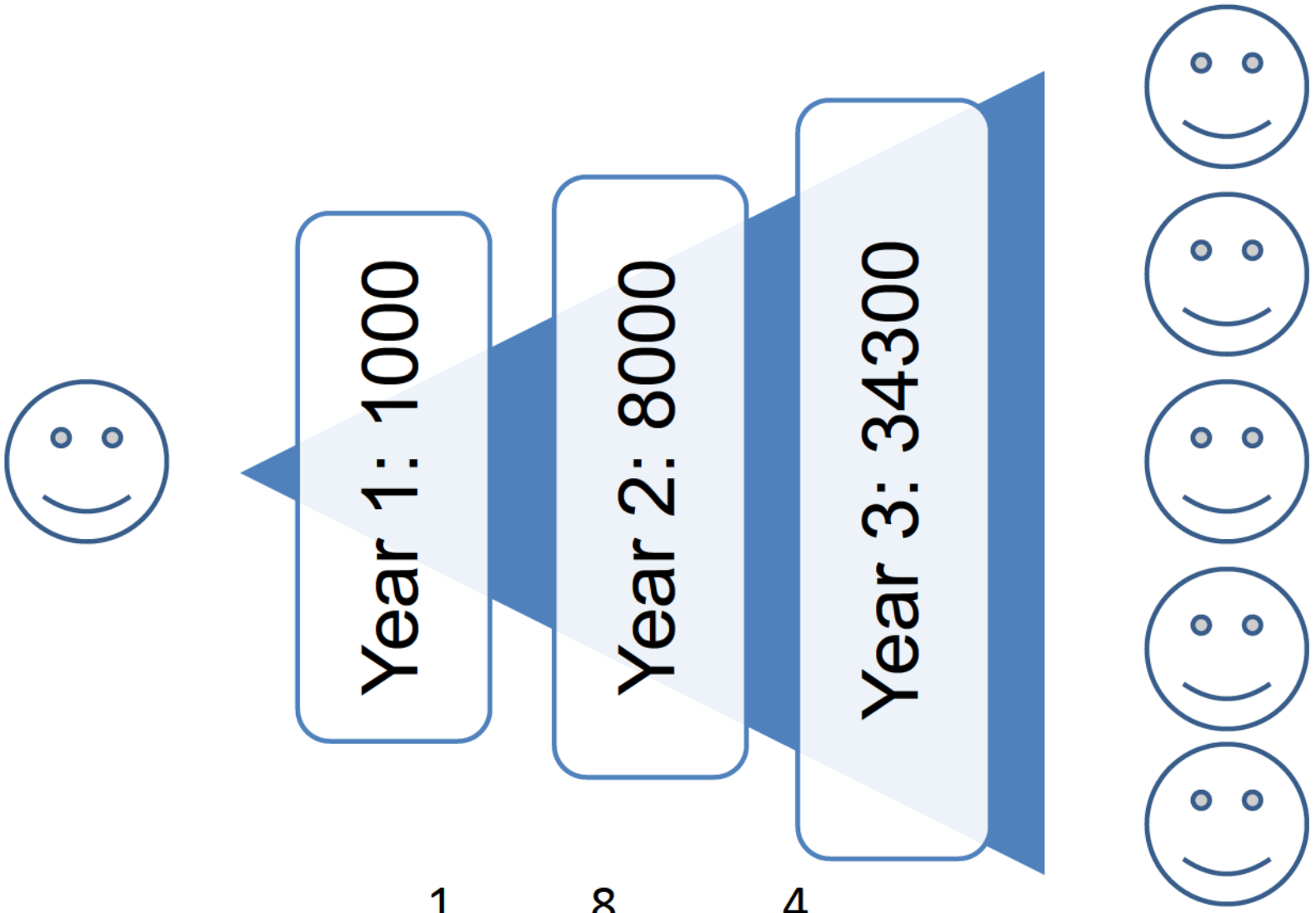
Adoption rate is 32-40%

- Socio-economic status (wealth)
- Farm size
- Household labor
- Access to information
- Membership in farmer organization
- *Warrantage*

Dissemination of Research Results

Outlet	Number	Remarks
Poster	4	54 cp.
Outcome story	1	600 cp.
Fact sheets	2	1000 cp.
Radio programs	20	10 000 pers.
Video documentary	1	300 pers.
Scientific publications	10	1 publ., 9 in prep.
Policy briefs	2	2000 cp.
Farmer field days	42	1200 pers.
Village meetings	40	2000 pers.

Number of Farmers Reached



Project Beneficiaries

	Farmers	Students	Extension and technical agents	Local decision makers, NGOs, project, public services
Female	12300	4	30	
Male	22000	6	124	
Total	34300	10	154	12
Support provided	Training, sensitization, farmer to farmer exch., mass media (radio, video)	Graduate Training	Training	Policy briefs, Outcome stories, poster, Fact sheets

Conclusions: Key messages

- With improved variety, MD and RWH can increased yield for up to 200 %
- Expanded MD in new sites and crops (Benin & maize)
- No evidence of the micro-dose induced land degradation and/or yield decline, suggesting long-term sustainability
- In short-term, micro-dose & RWH are an efficient and a profitable technologies to sustain crop production
- Integrating OM and MD mitigate risks and stabilize yields

Conclusions: Key messages

- *Warrantage* is a market-driven scheme which support the adoption of the micro-dose and attracts the private sector
- Higher involvement of women in micro-dose is linked to profit from the technology and access to credits and off-farm investment opportunities from the *warrantage* scheme

Acknowledgements

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Canada

University of Saskatchewan

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Faculté d'Agronomie Université de Parakou

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